ENGR1202 – Computer Engineering Assignment – Robotics and Control – Fall 2013

Assignment 2 – Motor Control/Power Lab Exercise

You will follow the Motor control/power lab exercise procedure below. Once you have run the exercise, demonstrate the moving vehicle to the lab TA to the lab TA and hand him the Lab Checkout sheet.

After you demonstrate the lab, write a short lab report (one page is fine). Submit ***ONE pdf document*** per group on Moodle. Make sure to include the group participant names in the document. Spelling and grammar COUNT in this graded assignment. . Name the document:
ENGR1202-Assignment2-lastname1-lastname2.pdf
where lastname1 and lastname2 are the last names of the lab partners.

You can use the space in EPIC 2130/2132 for this lab work.

Materials needed:

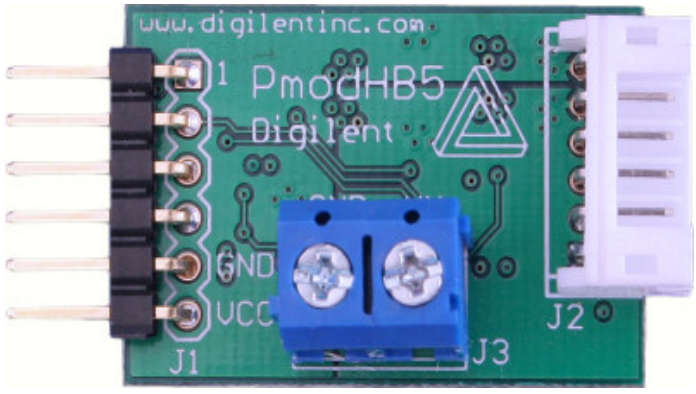
- Breadboard (you provide)
- Jumper wires(you provide)
- 4-AA batteries (you provide)
- Various tools (screwdrivers, pliers: you provide)
- 2-AA Battery holder (we provide, will be used for final project)
- Robotic vehicle (we provide, will be used for final project)
- 4-AA Battery holder (we provide, will be used for final project)

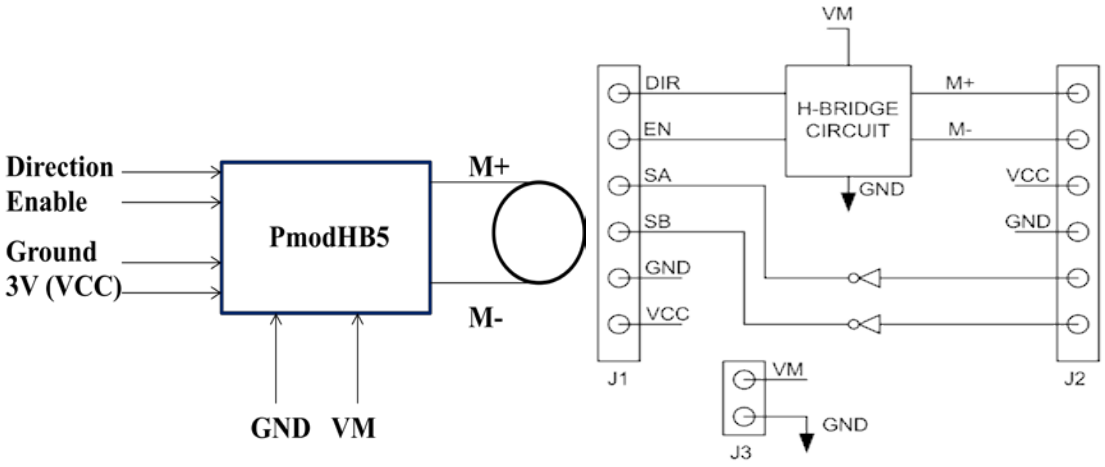
Objective of lab

In this lab exercise you will build two different circuits and record the results of each circuit you build using the materials listed above. Your group will then build and demonstrate the working vehicle and answer any questions the TA may ask.

Key Concepts

One of the key concepts of this lab is to understand how to look up information on he web - specifically, how to find technical datasheets. We are working with the Digilent DC motor robotic vehicle (discontinued since January, but information is still on the Digilent website www.digilentinc.com). The key component of this lab is the PmodHB5 - H-bridge w/ feedback inputs. This is a motor-driver board that will turn the motors, which will move your robot.





Schematic representations of the PmodHB5

- Direction: from the "computer" or other controlling device, 3v ("1") means counter-clockwise and 0v ("0") means clockwise. This will NEVER be 6v.
- Enable: 3v ("1") means turn, 0v ("0") means do not turn. This will NEVER be 6v.
- SA,SB: Not used
- GND: 0v
- VCC: "Computer" power, 3v. This will NEVER be 6v.
- VM: Voltage to drive the motor, will be 3v in one experiment and 6v in another experiment.

See the class notes for descriptions of the motor drive, but more importantly, read the datasheet from the Digilent website. Note that the cable from the motor to the Pmod plugs into jumper 2.

Exercise 1 - Parts

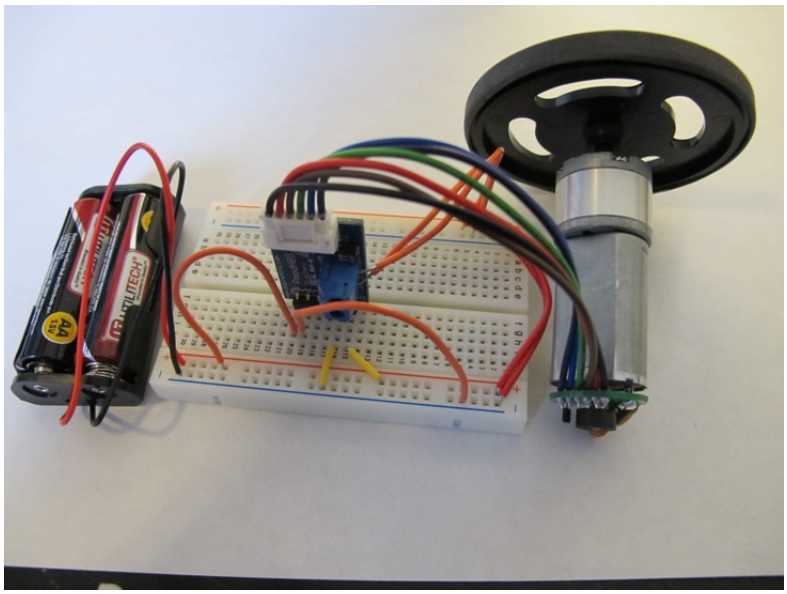
Inventory the parts from your box (handed out in class). Check the list for the Digilent site and make sure you have everything.

Question 1: What (if anything) was missing from the kit?

Exercise 2

Build the first test circuit (shown in the photo). Hook up Direction="1", Enable="0", VCC, GND, VM=3v, and plug in the motor. Note the operation - the motor does not move. Then change enable to "1". It should move. Now change Direction to "0". Observe the speed of the motor

Question 2: write the "Truth Table" of the motor, with Direction and Enable as the inputs (make it look like the AND or OR truth table).

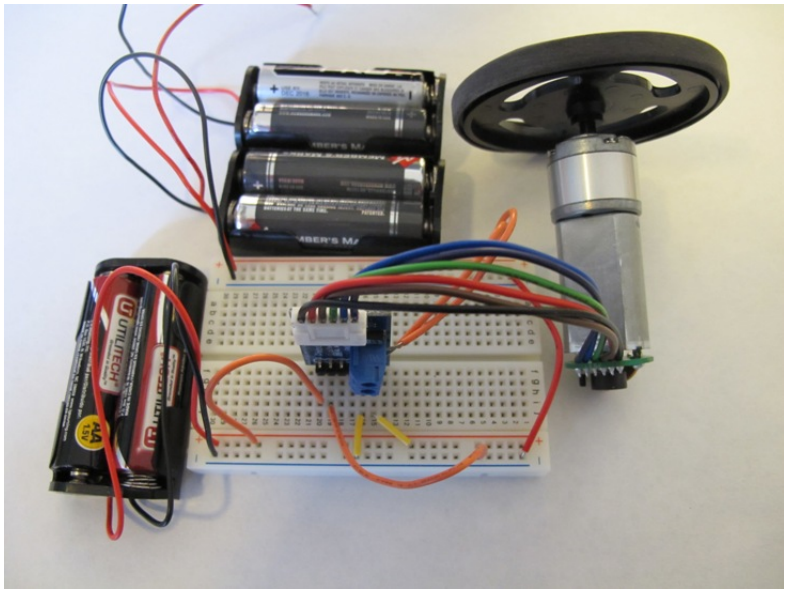


Exercise 3

For this exercise, use the other Pmod and motor supplied in your kit materials (we want to test both sets to make sure they work).

Build the next test circuit (shown in the photo). The major different is that you will supply 6v to the motor. Note in the photo that the "Ground" bars of the upper and lower bars of connected. **DO NOT CONNECT the top and bottom power bars** (that would be putting 3v and 6v as the same power source - not a good thing to do!). Hook up Direction="1", Enable="0", VCC, GND, VM=6v, and plug in the motor. Note the operation - the motor does not move. Then change enable to "1". It should move. Now change Direction to "0". Observe the speed of the motor

Question 3: Does the wheel turn faster with the 6v motor supply? If it does, how much faster?



Exercise 4

For this exercise, build your robotic vehicle using the Digilent instructions. You will use the breadboard to control your vehicle rather than a computer (that will come in a later lab). Note that the Pmods are on the bottom, with a wire connector wrapping to the top of the platform. You can put the battery pack on top or on the bottom.

In the assembly, remember that VCC is 3v and VM is 6v. Also, remember that Direction, Enable, and VCC will never be 6v.

Note the orientation of the motors. Because of this, to drive straight, one motor will need to turn counter-clockwise and one will need to turn clockwise.

TA Demo 1: Complete the vehicle by wiring it to continuously drive forward. Demonstrate this to the TA.

TA Demo 2: Then, moving just one wire, demonstrate to the TA that you vehicle can turn in place.

Question 4: Calling the motor of the left side motor "A" and the other "B", draw the truth table of the **vehicle's** behavior (i.e. forward, backward, turn clockwise in place), with Direction A, Direction B, Enable A, and Enable B as the inputs (make it look like the AND or OR truth table).